

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
7 July 2005 (07.07.2005)

PCT

(10) International Publication Number
WO 2005/060631 A2

(51) International Patent Classification: Not classified

(21) International Application Number:
PCT/US2004/041623

(22) International Filing Date:
13 December 2004 (13.12.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/528,660 11 December 2003 (11.12.2003) US

(71) Applicant (for all designated States except US): OHIO
UNIVERSITY [US/US]; 20 East Circle Drive, Suite 190,
Athens, Ohio 45701-3751 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): MIRACLE, Dr.
Daniel B. [US/US]; 2237 Shadowood Circle, Bellbrook,
Ohio 45305 (US). TAMIRISAKANDALA, Dr. Se-
shacharyulu [IN/US]; 2444 Mallard Lane, Apt. #3,

Beavercreek, Ohio 45431 (US). BHAT, Dr. Radhakr-
ishna B. [IN/US]; 2388 Edgewater Drive, Beavercreek,
Ohio 45431 (US). TILEY, Dr. Jaimie S. [US/US]; 220
South State Street, Verona, Ohio 45309 (US).

(74) Agent: FROST, Kristin J.; 800 Superior Avenue, Suite
1400, Cleveland, Ohio 44114-2688 (US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AB, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,

[Continued on next page]

(54) Title: TITANIUM ALLOY MICROSTRUCTURAL REFINEMENT METHOD AND HIGH TEMPERATURE, HIGH
STRAIN RATE SUPERPLASTIC FORMING OF TITANIUM ALLOYS



(57) Abstract: A method for refining the microstructure
of titanium alloys in a single thermomechanical processing
step, wherein the titanium alloy comprises boron. In some
embodiments, the method comprises the steps of first adding
boron to the titanium alloy then subjecting the boron-containing
titanium alloy to a thermomechanical processing step. Also
provided is a method for achieving superplasticity in titanium
alloys comprising the steps of selecting a boron-containing
titanium alloy, determining the temperature and strain rate
necessary to achieve beta superplasticity, and applying
sufficient temperature and strain rate to the boron-containing
titanium alloy to deform the alloy to the desired shape. Also
provided methods of forming titanium alloy parts and the parts
prepared by these methods.

WO 2005/060631 A2